WHAT IS CLAIMED IS:

1. A tissue-compatible polymer composite comprising a co-continuous, integrated multi-phase, three-dimensional microstructured network of two or more immiscible biocompatible polymers.

2. The polymer composite of claim 1, wherein, at least one polymer component of the composite is bioerodible, and erodes at a rate faster than at least one other polymer component of the composite.

3. The polymer composite of claim 1, consisting essentially of first and second polymer components.

4. The polymer composite of claim 3, wherein said second polymer component is bioerodible.

5. The polymer composite of claim 4, wherein said first polymer component is bioerodible and erodes at a rate slower than said second polymer component.

6. The polymer composite of claim 3, wherein the weight ratio of the first component to the second component is between about 15:85 and 85:15.

7. The polymer composite of claim 4, wherein said first polymer component is PMMA and said second polymer component is selected from the group consisting of PLA, PGA and copolymers thereof.

8. The polymer composite of claim 2, comprising PMMA and at least one polymer selected from the group consisting of PLA, PGA and copolymers thereof.

9. The polymer composite of claim 1, wherein at least one polymer phase comprises one or more substances or particles that promote bone or tissue ingrowth.

10. The polymer composite of claim 9, wherein at least one polymer phase comprises particles of hydroxyapatite or tricalcium phosphate.

11. The polymer composite of claim 1, wherein at least one polymer phase comprises one or more nutrient or pharmaceutical substances.

12. The polymer composite of claim 1, wherein at least one polymer phase is foamed.

13. A porous tissue-compatible polymer structure comprising a three-dimensional microstructured porous network.

14. The porous polymer structure of claim 13, wherein the polymer portion of the structure is a co-continuous, integrated multi-phase, three-dimensional microstructured network of two or more immiscible biocompatible polymers.

15. The porous polymer structure of claim 14, wherein said polymer portion comprises first and second polymer components, wherein said second polymer component is bioerodible.

16. The porous polymer structure of claim 15, wherein said first polymer component is bioerodible and erodes at a rate slower than said second polymer component.

17. The porous polymer structure of claim 15, wherein said first polymer component is PMMA and said second polymer component is selected from the group consisting of PLA, PGA and copolymers thereof.

18. The porous polymer structure of claim 13, wherein the polymer component of said structure comprises one or more substances or particles that promote bone or tissue ingrowth.

19. The porous polymer structure of claim 18, wherein said polymer component comprises particles of hydroxyapatite or tricalcium phosphate.

20. The porous polymer structure of claim 13, wherein the polymer component of said structure comprises one or more nutrient or pharmaceutical substances.

21. An implantable medical device or tissue scaffold formed from the composite of claim 1, 2, 3, 4, 7, 8, 9, 10 or 11.

22. A method of forming porous tissue compatible polymer structures having three-dimensional microstructured porous networks, comprising the steps of providing a tissue-compatible polymer composite having a co-continuous, integrated multi-phase, three-dimensional microstructured network of two or more immiscible biocompatible polymers, and dissolving in vitro at least a portion of at least one polymer.

23. A method of regulating cellular attachment, migration and proliferation on a polymeric substrate, comprising contacting living cells, tissues or biological fluids containing living cells with the polymer composites of claim 1.